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## ALTERNARIA FROM CALIFORNIA

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(WITH TWO FIGURES)

Frequent occurrence of a distinct spot on the leaves of cabbage and cauliflower<sup>1</sup> in certain sections of California led to an investigation of its causes and distribution. In culture media, infected leaf tissue taken from the spot yielded constantly a form of *Alternaria* which was found to be a species hitherto undescribed. Macroscopically the infected area appeared smooth, although somewhat sunken, but lacked the profuse growth of conidia and the zonation which characterize the lesions produced on leaves of cabbage by *Alternaria brassicae* (Berk.) Sacc. The disease was found to be restricted to that district of the state lying directly south of San Francisco, where high relative humidity and a uniform temperature prevail. In this district there have been planted annually about 2000 acres of cabbage and cauliflower for shipment to eastern markets, and in view of the frequency of the occurrence of the disease it may be the cause of a pathological problem in transit as well as in the field.

The first symptom of the disease is the appearance of small black specks about 1 mm. in diameter. Often countless specks appear simultaneously in the laminae. Infection occurs almost entirely on apparently vigorous leaves, young as well as old; and under conditions of high relative humidity the initial lesion may develop into a spot ranging from 0.5 to 1 mm. in diameter in fourteen days. The spots are circular, somewhat sunken, black with a purplish cast, the center being darker than the margin (fig. 1). The color depends largely upon the color of the leaf, for upon pale green leaves, as found on Winningstadt and Cannon-ball cabbage, lighter spots are produced than on the dark green varieties of cabbage. Sporulation of the fungus is sparse on still vigorous leaves, but becomes profuse on yellow and detached leaves.

<sup>1</sup> The term cauliflower includes both cauliflower and broccoli.

The causal fungus grew luxuriantly on all common culture media. Sporulation was abundant, and the mycelium was greatly suppressed. *En masse*, the color of the colony is light olivaceous on starchy media and dark olivaceous on nitrogenous media.

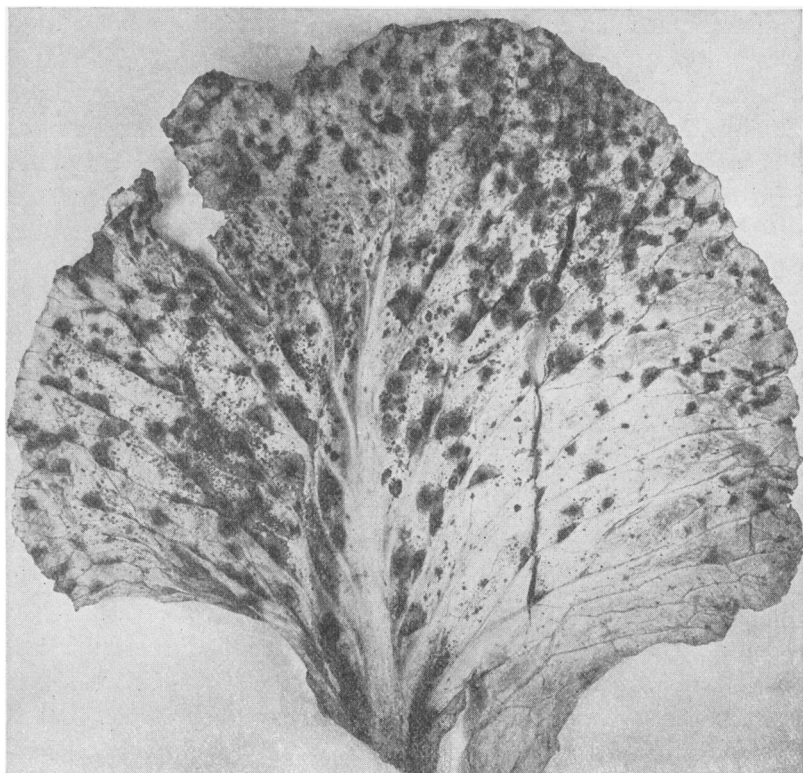


FIG. 1.—Cabbage leaf showing abundant spots caused by *Alternaria oleracea*; note absence of zonation characteristic of many *Alternaria* spots.

Zonation in the colony was not visible. A description of the fungus is as follows:

***Alternaria oleracea*, n. sp.**

Hyphae short, greatly subordinated, straight, sparsely branched, occasionally septate, very light olivaceous to hyaline, average  $4.5\ \mu$  in diameter; conidiophores short, light olivaceous, short

branched, branches almost even in length, about  $35\ \mu$ ; conidia olivaceous to brown, echinulation none in culture four months old, tapering very slightly to apical cell, tapering frequently absent, apical cell frequently hyaline, conidia catenulate, as many as eight in one chain, catenulation both on host and on culture media, longitudinal septation very rare, considerable constriction of the walls at septation, size of the conidia taken from artificially inoculated cabbage leaf  $29.7\text{--}61.2\ \mu$  by  $8.7\text{--}12.3\ \mu$ , average size  $43.7$  by  $10.5\ \mu$ . Conidia developed on standard lima bean agar measured on the seventh day as follows: 1-septate,  $13.4\text{--}16\ \mu$  by  $6.5\text{--}7.5\ \mu$ ; 2-septate,  $17.5\text{--}18.7\ \mu$  by  $8.7\ \mu$ ; 3-septate,  $20\text{--}26.5\ \mu$  by  $8\text{--}12\ \mu$ ; 4-septate,  $34\text{--}36\ \mu$  by  $12.5\text{--}14\ \mu$ ; 5-septate,  $30\text{--}38\ \mu$  by  $9.5\text{--}14\ \mu$ ; 9-septate,  $64.7\text{--}70\ \mu$  by  $10\text{--}14\ \mu$  (fig. 2).

Inoculation experiments with pure cultures were made on growing cabbage and cauliflower plants in the field and in pots under control in glass cages, at the field station of the Office of Cotton, Truck, and Forage Crop Disease Investigations, located at Alhambra, California. The varieties of cabbage used in these experiments were Winningstadt, Late Drumhead, Early Jersey Wakefield, and Fat Dutch, and the varieties of cauliflower were two selections commonly grown in the San Francisco district. In Alhambra the relative humidity of the atmosphere is considerably lower than in the San Francisco district, where the disease is prevalent. On account of this variation, open field inoculation did not progress above a small speck. When the inoculated leaf was covered with a wax paper sack in which there had been suspended a water-soaked mass of gauze, lesions of normal size were produced readily. Successful infections were produced by spraying conidia, suspended in water, on uninjured leaves, and by wounding and inserting conidia. Infections were obtained more rapidly in glass cages where high relative humidity could be maintained. Within seven days lesions ranging in diameter from 1 cm. to 1.5 cm. were produced. Similar inoculation experiments were made with *Alternaria brassicae* obtained from old cauliflower and cabbage leaves, and with *Alternaria* sp. from spots on tomato fruit. The former produced spots with definite zonations, while the latter failed to grow on cabbage and cauliflower.

Black leaf spot of cabbage has been attributed to the fungus *Alternaria brassicae* for a long time. HARTER and JONES<sup>2</sup> state that the black spot fungus may attack the cabbage plant at any stage of its growth, but it is not common except on the older leaves in the field or on heads in storage. In the field it appears on the lower or outer leaves of the maturing plant as distinct, roundish,

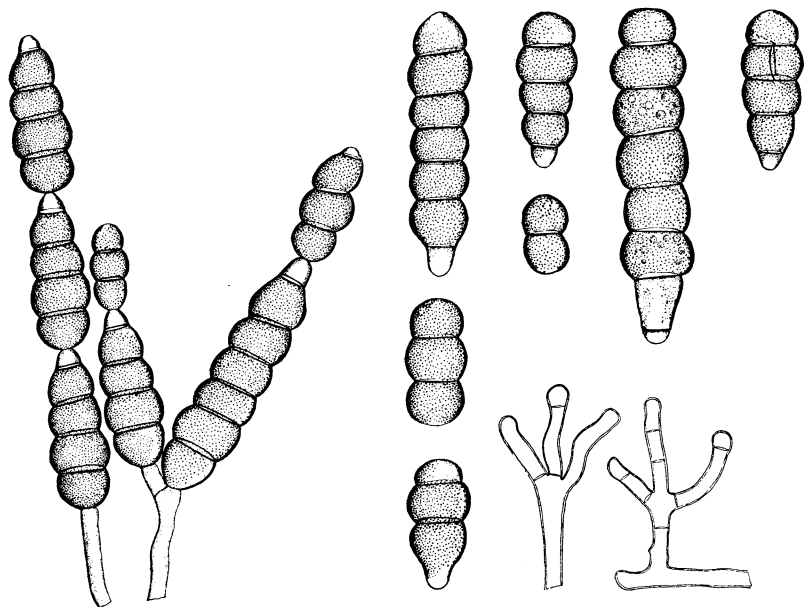


FIG. 2.—Types of conidia and conidiophores of *Alternaria oleracea* from cabbage leaf.

black spots, commonly marked with concentric brown zones. SACCARDO<sup>3</sup> describes the fungus *A. brassicae* (in translation) as follows:

Hyphae short, compact, little branched, even growth, in tufts; conidia deciduous, elongate, fusoid, clavate, size 60–80  $\mu$  by 14–18  $\mu$ , 6–8 septate, muriform, olivaceous; fungus found on decaying and old leaves of *Brassica oleracea*.

<sup>2</sup> HARTER, L. L., and JONES, L. R., Cabbage diseases. U.S. Dept. Agric. Farmers' Bull. 925. figs. 13. 1918.

<sup>3</sup> SACCARDO, P. A., Sylloge Fungorum 4:546. 1886.

MASSEE and COOKE give similar descriptions, except that COOKE employs the term *Macrosporium brassicae* Berk., and describes the conidia as antennaeform, rather longer than the peduncle. ELLIOTT<sup>4</sup> concluded that *A. brassicae* is morphologically similar to *A. solani* (E. and M.) Jones and Grout, and placed both in the same group, which he based upon having long, narrow, regular, tapering spores with few longitudinal septae. It appears that the form of *Alternaria* which the writer dealt with differs from *A. brassicae* both morphologically and in the form of spot produced on cabbage. In view of this difference, it is highly probable that a new species is involved in the production of the leaf spot found in the San Francisco district, and it is suggested that it be named *Alternaria oleracea*.

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<sup>4</sup> ELLIOTT, JOHN A., Taxonomic characters of the genera *Alternaria* and *Macrosporium*. Amer. Jour. Bot. 4:439-476. pls. 19-20. 1917.